Novel Separation of Stem Cell Subpopulations

Grant Award Details

Novel Separation of Stem Cell Subpopulations

Grant Type: Tools and Technologies I

Grant Number: RT1-01074

Investigator:

Name:	Lisa Flanagan
Institution:	University of California, Irvine
Type:	PI

Human Stem Cell Use: Adult Stem Cell, Embryonic Stem Cell

Award Value: $861,122

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: NCE

View Report

Grant Application Details

Application Title: Novel Separation of Stem Cell Subpopulations

Public Abstract:

The inability to separate stem cells and their differentiated progeny accurately, easily, and rapidly undermines progress in the stem cell field. Traditional separation of living cells into subpopulations relies on techniques that utilize characteristic cell surface markers, but specific markers are severely limited or lacking altogether for many stem cell populations. Without ways to discriminate and isolate subpopulations of stem cells and their derivatives, controlling the purity of cells for in vitro studies or transplantation is impossible.

A different method termed “dielectrophoresis” (DEP) may provide a label-free and unbiased method to address these stem cell sorting issues. DEP employs a non-toxic electric field to attract or repel cells in a frequency-dependent manner independent of marker expression. DEP detects intrinsic cell components such as presence and distribution of charges in the membrane and cytoplasm. A variety of cells have been separated using DEP, including subpopulations of human white blood cells. However, this approach was only recently applied to stem cells when it was shown that DEP distinguishes mouse neural stem/precursor cells (NSPCs) and their differentiated progeny (neurons and astrocytes). Furthermore, the response of NSPCs biased to generate neurons to DEP is different from that of cells predisposed to make astrocytes, which is important since these NSPC subpopulations cannot currently be discriminated by markers. We have extended DEP studies to human cells and find unique DEP responses of human NSPCs that generate greater numbers of neurons. Therefore, we hypothesize that stem cell subpopulations of interest for both research and clinical applications, such as committed neuronal progenitors, can be isolated by DEP.

We will determine the applicability of DEP to the separation of stem cell subpopulations by designing novel DEP sorting devices and using them to isolate human neuronal progenitors from primary human NSPCs and human embryonic stem (ES) cells differentiated along neural lineages. We plan to make a straightforward DEP device for distribution to the stem cell community in order to allow testing with other stem cell types. We expect to validate the utility of DEP as a novel strategy that can utilize cells’ DEP responses as unique biomarkers for the rapid separation of stem cell subpopulations that cannot be isolated by other means. In the course of these studies, we expect to isolate human progenitor cells that specifically generate neurons, a cell population of interest for basic biological studies, therapeutic approaches, and as a source of human neurons for drug testing.

Statement of Benefit to California:

The goal of this project is to determine whether a novel strategy using DEP can serve as a complementary and alternative approach to marker-based separation of stem cell subpopulations. In the course of these studies, we expect to isolate human progenitor cells that specifically generate neurons, a cell population of interest for basic biological studies, therapeutic approaches, and as a source of human neurons for drug testing. We propose to make our technology available to other stem cell researchers in order to rapidly assess it's utility with a wide variety of stem cell types. Our hope is that this label-free method for isolating stem cell subpopulations will greatly increase the speed of stem cell research in California and hasten therapeutics.
